DEPARTMENT OF ENERGY

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OFFICE OF ENERGY EFFICIENCY AND RENEWABLE ENERGY

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BUILDING ENERGY CODES PROGRAM:
WORKSHOP ON ANALYSIS OF STANDARD
90.1-1999

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THURSDAY,

FEBRUARY 17, 2000

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The public workshop was held at 9:00 a.m. in Room 1E-245 at the U.S. Department of Energy, Forrestal Building, 1000 Independence Avenue, S.W., Washington, D.C., Jean J. Boulin, presiding.

Present:

DOUGLAS BROOKMAN, Facilitator,
Public Solutions, Inc.
JEAN J. BOULIN, DOE
HAROLD N. CROWDER, Virginia Power
ERIC DeVITO, Andersen Windows and Cardinal IG
SUSAN DOUGLAS, NFRC
CHARLES R. FOSTER, EEI
JASON GLAZER, GARD Analytics, Inc.
RAOUL GREISS, National Resources Canada
HAROLD W. HEISS, American Electric Power
ROBERT J. HEMPHILL, GRI
RONALD MAJETTE, DOE
JOSEPH M. MATTINGLY, GAMA
FRANCINE PINTO, DOE
JAMES A. RANFONE, AGA
STEVE TURCHEN, DOE
TED A. WILLIAMS, AGA
DAVID W. WINIARSKI, PNNL

I-N-D-E-X

P-R-O-C-E-E-D-I-N-G-S

(9:09 a.m.)

MR. BOULIN: My name is Jean Boulin. I'm presiding officer for this workshop.

The others joining me today are Francine Pinto from our Office of General Counsel; Ron Majette from the Office of Building Research and Standards; David Winiarski from our Pacific Northwest National Laboratory; and at the head of the table here many of you will recognize Doug Brookman of Public Solutions, Inc. He will facilitate and set the guidelines for conducting this workshop.

On behalf of the Department I would like to thank you all for taking the time to participate in this public workshop.

We've chosen the format in order to facilitate the exchange of ideas and information in an informal manner. The Department is required by Section 304(b)(2) of Title III of the Energy Conservation and Production Act, as amended, to determine whether the revisions to ASHRAE/IESNA Standard 90.1 embodied in the 1999 edition will improve energy efficiency in commercial buildings.

In preparation for making the determination, we are doing a comparative analysis between the 1989

edition and the 1999 edition of Standard 90.1. An initial analysis was prepared in the summer of 1999 and the results were presented to the Standing Standards Project Committee 90.1, the ASHRAE committee responsible for revising the standard. It was also shared with other interested parties.

At that time we identified the shortcomings that we perceived in the analysis, and suggested how some could be resolved. Comments were requested on these issues and other issues that people might identify. We have developed an approach to complete the analysis and that address these issues that we identified last summer.

We are holding a workshop today to obtain comments on the approach and to identify any other issues. This workshop was the subject of a notice published in the Federal Register on February 8, 2000. Materials relating to this workshop will be posted on our web site at: http://www.energycodes.org -- all one word "energycodes."

In approximately two weeks, a complete set of the transcript will be available for inspection and copying at the Department of Energy's Freedom of Information Reading Room located in Room 1E-190. Anyone wishing to purchase a copy of the transcript may make arrangements with the court reporter here in the front of

the room.

Our agenda will basically be this opening statement, a review of the format of this session. We'll go around the table with introductions, a brief, terse background again which will be open for discussion. The proposed methodology. We'll first go through a presentation followed by comments. We'll then have scheduled speakers, if they want to make additional comments and then people who have not scheduled with us we'll have time for additional comments to be made.

The format of the workshop, we have a facilitator, who is as I have said, Doug will facilitate for us. We'll go through the methodology in the following way: first a presentation by component. We'll take these one slat at a time. Comment and discussion on the immediate subject matter. We'll then go on to the next item. We will do comments and discussions first by scheduled speakers who have something in their remarks on the subject and then to the rest of the room. If you agree with something that's been said, please don't say it again, affirm that you agree with the statement. It will keep our time to a better situation.

We'll get into the scheduled speakers, as I've said, with other comments. We will then have comments and discussion on those particular comments.

Attendees will come next and we'll have comments and discussion on those. To provide the Department with as much pertinent information and as many views as can be reasonably obtained and to enable interested parties to express their views, we will follow this format.

We expect that we will have ample time to raise and discuss all important issues. We would ask, however, that you refrain from making overly lengthy statements, so everyone gets a chance to speak and Doug will enforce our ground rules.

During the short presentations, please hold your comments. We will make sure there is sufficient time to comment and have discussions as we move from one subject to the next.

The workshop is scheduled to adjourn today at 4 o'clock unless, of course, we finish early. Topics which have not been completely discussed by that time can be addressed in additional written comments which are due by February 24th, a week from today. All written comments and data submissions should be available for public inspection at the Department of Energy of Information Reading Room. The phone number for that is 202/586-6020.

Please send written comments to Brenda Edwards here at the Department of Energy and reference

the docket number 6450-01-P when you respond. We would like to have ten copies of your comments and any supporting data, along with an electronic copy of the comments or data, preferably using Word Perfect 8.1 or an earlier version. No faxed comments will be accepted.

Any person submitting information which he or she believes to be confidential and exempt by law from public disclosure should submit one complete signed copy, plus ten copies and a copy on a disk from which information claimed to be confidential has been deleted. In accordance with the procedures established at 10 CFR Part 1004.11, the Department of Energy will make its own determination as to whether the information shall be exempt from public disclosure.

Again, we appreciate the time and effort you have taken in preparing for this workshop, and we are pleased to receive your comments and opinions. Our purpose today is to listen to your views.

With that, I'd like to go around the table and have you introduce yourself so that we all know who's here.

Can we start with you, Harold?

MR. CROWDER: Sure. Harold Crowder, Virginia Power.

MR. FOSTER: Chuck Foster, Edison Electric

Institute.

MR. HEISS: Harold Heiss, American Electric Power.

MR. DeVITO: Eric DeVito, I represent Andersen Windows and Cardinal IG.

MS. DOUGLAS: Susan Douglas, National Fenestration Rating Council.

MR. GLAZER: Jason Glazer, GARD Analytics.

MR. RANFONE: Jim Ranfone with the American Gas Association.

MR. HEMPHILL: Bob Hemphill, GRI.

MR. WILLIAMS: Ted Williams, American Gas Association.

MR. GREISS: Raoul Greiss, Natural Resources Canada.

MR. MATTINGLY: Joe Mattingly, FAMA.

MR. WINIARSKI: David Winiarski, Pacific Northwest Laboratory.

MR. MAJETTE: Ron Majette, U.S. Department of Energy.

MS. PINTO: Francine Pinto, Department of Energy, General Counsel's Office.

MR. BOULIN: Okay, what I'd like to do now is to have Doug take over, review the agenda and provide some housekeeping details, provide a few additional

ground rules.

MR. BROOKMAN: Thank you. Can you pick that up?

COURT REPORTER: It's nicer if you have a microphone, but for introductions, it's okay.

MR. BROOKMAN: Good morning. I'm Doug Brookman. I've had a chance to meet many of you in the past. Nice to see you again. Thanks for being here on time so we can start just about on time.

What have emerged as norms for these working sessions over the years are as follows and I'd like to ask that you consider them and conform to them today as we go along. I'm going to ask that you speak one at a time, say your name and use the microphones. This will be a recorded session today and as Jean said, a transcript will be available.

I'm going to ask also that you be concise, share the air time. We want to fit in as much diversity of views as possible as we go along here today.

Listen as an ally. I find that the discussion and that's what we hope to encourage here today hinges entirely on the quality of the listening, so if you can focus in on that, we'll all be better off for it.

I'm going to ask also that you limit side

bars and interruptions. Those of you that need to make a telephone call on your cell phone or have your pager ring or something like that, please take it outside or wait until a break to conduct that business. I'd like to see if we can keep focused on the matter at hand here today.

We will take a break this morning around about 10:30, 10:45 and this afternoon around about 2:15 or 2:30 so you can anticipate there will be one almost no matter where we are, you can anticipate that.

I'd also just like to acquaint you with what I typically try and do which is to queue people to speak based on when I see that hands go up or somehow showing to me they wish to comment on the slides or the matter being discussed.

I also like to allow for follow on comments, so I may have three, four, five people stacked to speak and if someone wishes to make a brief follow on comment, I try and fit that in to keep the discussion going. So it's a complicated system and if I leave you out of the queue, don't let me get away with it. Flag me down, chase me down at the break and do something, but just make me aware that I've forgotten you and I will correct it on the spot.

So that's what I'd suggest as simple ground

rules, norms for the meeting today. As Jean said, the purpose here is to generate some useful discussion, to listen, and that's what we hope to do.

Do we need any additional ground rules or norms for today? Okay, thank you. So then, let's proceed.

MR. BOULIN: That's much easier. I want to focus us again on what we're talking about here. We're talking about building energy codes. EPCA Section 304(b)(2)(A) requires the Secretary to make a determination as to whether the revisions in ASHRAE Standard 90.1 in this case a 1999 version, will improve energy efficiency in commercial buildings.

A preliminary analysis of office and retail buildings was done in June and shared with a number of people. This workshop is in preparation for completing that analysis and making the subsequent determination that the Secretary must make.

The notice of this determination will be published in the Federal Register, we hope this spring. And affirmative determination in this case would cause States to certify to the Secretary within two years that their codes meet or exceed 90.1-1999, the implications of some of the things we're about today.

With that, I'll open it up for any comments

on this subject. Are there any comments on what we're about to hear today?

Jason?

MR. BROOKMAN: Say your name for the record.

MR. GLAZER: Jason Glazer. I was wondering what the determination has been in the past for addenda to the 1989 version of the standard.

MR. BOULIN: We have not made any determinations relative to the 1989 version of the standard.

MR. RANFONE: Jim Ranfone with AGA. Does the law require DOE to do that on addendum or not?

MR. BOULIN: The law is silent explicitly on when the Department makes those changes.

MR. RANFONE: Jim Ranfone again. Just a clarification then. When the addenda was issued on the 1989 version, is that considered a new standard, therefore DOE has within one year to --

MR. BOULIN: We are generally making a determination when a new standard is published. In those cases a new standard was not per se published.

MR. GLAZER: Jason Glazer. Actually, I believe there was a version of the 1989 standard that was published with addenda incorporated after EPAC.

MR. BOULIN: Thank you.

MR. BROOKMAN: This is Doug. I'm trying to understand where you're going with this question, Jim.

MR. RANFONE: Jim Ranfone, AGA. I guess if there's some historical precedent on what DOE did prior to the issuance of this new standard, we'd like to know methodology was used then on addenda to make this determination and if nothing was done, we'd like to know that too. Legally is DOE required to make that -- were they required to make that determination even prior to the issuance of the 1999 standard?

Basically, what we're trying to find out is was there anything done and what was the methodology done on those addenda and how does that impact or how would that be portrayed or utilized in this process that you're talking about now that we're involved in now. That's the reason for the question.

MR. BROOKMAN: I understand. So in addition to the methodology which I think is fairly well described in the documentation here today, you wish to know about the precedential nature of those others?

MR. RANFONE: Right. Perhaps, Jim Ranfone, does legal counsel have a comment?

MS. PINTO: Well, I think that Jean has answered the first question -- Francine Pinto, General Counsel. Jean answered, Jean Boulin answered your

question that the Department has not done that in the past. So there isn't any previous methodology. We have never looked at that issue as to whether on specific addenda we would have to do it. The legislation talks about the standard as a whole, so I don't have a specific answer to that. We haven't done it though.

MR. RANFONE: Would we be able to get an answer in the future? Jim Ranfone.

MS. PINTO: I'm sure we can look at it and address it in the determination if it becomes necessary. Do you see a particular reason why it needs to be addressed?

MR. RANFONE: Jim Ranfone. Again, the reason is if an analysis was done and DOE made a determination, what methodology was used? And if there was a methodology that's consistent or inconsistent with what is being proposed today we would just like to know that.

MS. PINTO: Well, it hasn't been done.

MR. BOULIN: There has been nothing that has been done.

MS. PINTO: Has definitely been done.

MR. BOULIN: We made no determination. We did not analysis on the addenda.

MR. RANFONE: Jim Ranfone. So you feel that

DOE did not have to do a determination back then on those addenda?

MS. PINTO: Are you speaking of just our addenda?

MR. RANFONE: Yes. If that's the answer, that's fine.

MS. PINTO: I believe so and I haven't actually spent a lot of time thinking about that particular issue.

MR. RANFONE: Thank you.

MR. BOULIN: Okay, if there are no other questions --

MR. GREISS: Raoul Greiss from Natural Resources Canada. I guess it is an important issue if the addenda applied to the current version of the standard and if the standard is referenced, will the addenda be applicable on an on-going basis and will they be considered parts of the ruling or not?

MR. BROOKMAN: Is that a subject to be determined based on the analysis or does the Department have a predisposition on this point of the addenda now?

MS. PINTO: I believe the addenda -- do you agree with me, Jean, that the addenda would be included as part of the total standard?

MR. BOULIN: The addenda -- we're moving

into a different situation now that the 1999 standard is published. It's ASHRAE's intention, I'm informed, to move into a mode of continuous maintenance which is somewhat similar to the code process that we're seeing and to aggregate those addenda that occur to that standard and publish that every three years, very much like the codes do.

On the residential side, it's been our practice in the past to make a determination relative to the model energy code and now the IECC when it is republished. And we have followed that previously. It has been our intention in thinking about this to make a determination at the next publication of standard 90.1 in the same way so if they republish that say in 2002, we would expect to make a determination relative to that point.

The issue that we are looking at in considering this has been an issue of the actions that causes States to take and the time and effort for those States to update their codes. If we made a determination on addenda every year, this would cause the States to have to consider updating their codes every year and this has been a point that we have thought about, this has been behind our thinking.

MS. PINTO: Jim, I just want to add one

thing. In just looking at the language here, it says -- this is Francine Pinto -- it says the standard or any successor standard, so I would tend to agree with Jean that every time an addenda came out, I don't believe the Department would be required to make a new determination. My understanding of addenda is that they are amendments, minor changes, generally.

MR. RANFONE: Well --

MS. PINTO: Well, that would be my initial reading of that. As I said, we haven't spent a lot of time talking about it, but that would be my opinion at this minute.

MR. RANFONE: Jim Ranfone, AGA. It is an important issue. You say that some of the addenda may be minor and that they shouldn't be analyzed, but besides the methodology issue what we're interested in is what's the baseline that PNNL or anybody else using to do the comparison. Is it going to be straight 1989 version without the additional addenda that were approved or will it be with the approved addenda. So as a baseline issue here too.

MR. BROOKMAN: I think it's useful and I appreciate it, I'm sure everyone does the Department trying to interpret here real time on the spot what some of this might mean, but maybe it's an issue for further

consideration as we go along.

MR. RANFONE: That would be fine.

MR. BROOKMAN: So I'm going to suggest that we move on with the items that come next, Jean.

MR. BOULIN: Thank you. With that, Dave?

MR. WINIARSKI: Well, as in the introductions my name is David Winiarski. I'm a research engineer with Pacific Northwest National Laboratory. And I'm going to talk about this methodology or proposed methodology for evaluation of the change from 90.1-89 to 90.1-99.

Jim, one of the things I want to say is I've asked myself that same question. I think it's a very good question. I'm not sure how we're going to deal with this. The proposal, at least that we're looking at is to look at the latest version of the standard 90.1-89 and compare that with the published version of 90.1-99. We may address some of the proposed addenda and what the implications of those may be for the 90.1-99 standard in a qualitative manner, but -- go ahead.

MR. RANFONE: Jim Ranfone. I'm sorry, you are going to also look at the addendum that in the process for the 99 version?

MR. WINIARSKI: We may look at them from a qualitative standard, qualitative look at them whether we

think that those will be improvements. Certainly, I don't think the Department can base their determination on those addenda until they're approved and reevaluated as a whole.

MR. RANFONE: Jim Ranfone. Well, I guess we'll have some discussion about the qualitative analysis, but --

MR. WINIARSKI: Right.

MR. RANFONE: Or the need for it.

MR. WINIARSKI: Right.

MR. BROOKMAN: As a process clarification, we intend to essentially one slide -- or if there's a major point that sticks out that you'd like to comment as we're going. We'll have discussion after each individual slide, okay?

MR. WINIARSKI: Let me back up here. Back up. I'm going to talk a little bit about the methodology. What I would like the folks in this room to do is to -- with the overview and the methodology, we will come up with areas where we have made assumptions. We would like to get your input on those assumptions, both positive or if you have additional data that you can come in and present or data that will fill in our assumptions or expand them or possibly change them. Again, this is an on-going process.

We'd like you to provide information on the areas of the study that are important and if there are areas that we feel are not important or that can be glossed over in favor of doing more detailed analysis somewhere else, we'd like that type of information. Again, provide as much as constructive criticism on how to make this a better product.

Finally, we will have results both from a quantitative assessment of the entire standard as a whole and also from individual criterion and requirements in the standard and I'd like you to consider the impact of this assessment and possible modifications to the standard or to State codes which are derived thereof.

The standard or the analysis is going to be twofold. Part of the analysis will be based on what I call a qualitative look at the standard. Part will be based on a quantitative look. I'll talk very briefly on the qualitative analysis. The goal of that is to provide for a comparison of efficiency by major sections of the standard and by individual requirements of the standard where that's possible.

Identify areas where the scope of the standards are different and examine the impact of that change in scope on efficiency. That scope is both small s and capital s. There is a scope section of the

standard that discusses what buildings are covered, but there are also changes in scope in that some requirements have fallen out of the standard and new ones have been introduced.

And obviously comparison of a new requirement where one wasn't there before can be difficult. So that's part of what goes into the qualitative analysis, basically an assessment of that and once that goes out, we'd like other persons' input on our assessment.

There was a change in the structure of the 90.1 standard in that to the extent possible 90.1-99, the requirements were written in a mandatory language. That's not necessarily true for 90.1-89. Because of that, the things that were nonmandatory, but good suggestions for building design may have been dropped. That changes the -- what the standard actually covers and what can be impacted. That's an area that we want to look at in the qualitative analysis.

There are areas where the 90.1-99 stringency has been relaxed and it's fairly obvious that that's happened. We'd like to examine the reason why that was done. Again, that may be information best used for States who are looking at adopting their own codes.

And again, another large -- importance of

the qualitative analysis is to provide data for the individual State by State evaluations of 90.1-99 and how that can be incorporated into those State codes.

MR. BROOKMAN: Questions, comments on this first slide?

MR. WINIARSKI: The qualitative analysis, these are sort of the principal areas that we will look at. The general -- the scope of the standard, what's being covered, what's not being covered. One of the big changes in 90.1-99 is that there is introductions for requirements for building alterations that didn't exist in the 90.1-89 version.

There are probably vastly more building alterations that go on than new building construction in terms of total square footage, but the 90.1-99 requirements can't be assumed to be applied quite as completely to those alterations. There's lots of exceptions. So we're going to try and look at that and the impact of that.

And also the fact that a number of States may, by themselves have been using 90.1-89 also in their own requirements for changes in existing buildings.

We're going to look at the three major sections of the standard that we believe are important, the envelop requirements, lighting requirements for

buildings, mechanical equipment and system designs. That covers both HVAC and service water heating equipment as well as some just general electrical equipment in a building.

We will briefly touch on the different paths to compliance in the standard both in terms of whole building paths to compliance and individual paths in each of the above three sections. In general, we will be taking or examining what we feel to be the most common paths to compliance and in the quantitative analysis and assessing alternative paths more in a qualitative manner, whether we feel that they're going to be equal energy paths to compliance as much as possible.

The qualitative analysis is on-going right now. We're beginning the phases of putting together the quantitative analysis. The goal of the quantitative analysis is to examine the whole building impact of changes and requirements. The qualitative analysis can be used to assess, for instance, if the R-value of insulation in a wall has been increased or decreased fora given common type of construction, but where all kinds of different requirements are being change din the building, it's hard to assess the relative contribution of each of those requirements to the entire building energy saving. So that's the main purpose of the quantitative analysis.

The quantitative analysis again will focus on the major energy systems that we feel can be modeled effectively. It will attempt to cover a broad range of building types and also of locations in the country to get an idea of the national impact on building energy efficiency.

We'll also look or try to account for variation in buildings and system designs where we feel those are important for the determination tasks. Again, the focus here is going to be an analysis that determines whether or not we believe the standard will save energy. I personally don't believe we can come up with a real good assessment of the actual percentage of energy saved in commercial buildings. I don't think that we can describe our baseline well enough so that there's enough information to do that. For that reason it's primarily a standard to standard comparison, instead of a comparison between current practice and future practice.

MR. BROOKMAN: Steve Turchen, use the microphone, please.

MR. TURCHEN: Steve Turchen, U.S. Department of Energy. You touched, Dave, on both the qualitative analysis and you started on the quantitative analysis. Is the determination ultimately to be based on one or the other or some combination thereof?

MR. WINIARSKI: That's really a question for DOE. I don't know if Jean you want to touch on that.

MR. BROOKMAN: Are you in a position to answer that yet or is that --

MR. BOULIN: I don't believe until we see the analysis that we are in a position to make any statement as to what that determination will be fully based on.

MR. BROOKMAN: Okay, thank you.

MR. WINIARSKI: Right, in general, I view our role as a provider of information here and as much as possible we will do what we can to provide DOE with the type of information that will help in making their decision.

The basis for the energy savings estimates that we're going to do are a utilization index comparison between 90.1-89 and 90.1-99. By that I mean something like energy use, BTUs per square foot. We plan to look at both a site-based energy use, what would be in the building, a source energy use that accounts for the generation efficiencies in producing electricity which is obviously important and an energy dollars per square foot estimate for commercial buildings as a whole and also for each individual sort of slice of the building pie that we're analyzing so that that information will be

available for public consumption.

Briefly, I'll touch on what was done last summer that Jean alluded to. In the spring of 1999, I was involved in putting together a real cursory look at energy savings from the standard in two building types, an office and a retail building. We looked at two types of wall construction, a lightweight wall construction. Here, steel frame was used as the basis for that. And mass wall constructions. The reason behind that is that's been a topic of consideration in the standard and the R-value or U-value requirements for the walls change quite a bit for the mass wall construction in particular.

We looked at buildings that were heated by fossil fuel, in this case a gas furnace or electrically heated, in this case an electric furnace. We assumed a 90/10 mix across the country when we were coming up with a national aggregation of that. We looked at the 11 representative climates. In general, that analysis suggested energy savings for these building types on the order of, I believe, 16 to 18 percent depending on what -- or 16 to 20 percent depending on what type of metric you used. And I wasn't, unfortunately, able to -- that work was presented in the June ASHRAE meeting, June 1999. I didn't present it.

I think to some extent it's been misquoted a little bit. I want to make that clear that this is again for two building types. They are the two most important building types that we have in the commercial sector, but it is only two and we actually expect that the results that we get from this determination will have a lower energy savings from that.

The rationale behind that is that in 90.1-99 a large portion of the energy savings comes from improvements in cooling efficiency and in lighting. These two building types, cooling loads, can be very high, for other building types and we use the example of warehouse buildings. This certainly won't be the case and that's one building type where we actually expect to see an increase in energy is what the 90.1-99 standard.

What I'm going to talk about here is basically enhancements to that methodology. First, on the order of the enhancements is that we recognize that there's a lot of things that we simply can't model either from time and budget constraints or from the difficulties of actually using a tool or developing an analysis that models something very effectively, or more importantly, from which we don't have data to assess the national impact.

We can't aggregate that to a national level

because we don't have enough information, for instance, how often a particular requirement gets put in place in a building. So that's a primary reason for the qualitative analysis, to look at different requirements in the standard and the standards and say are we going in the right direction in terms of energy efficiency.

Another enhancement that we proposed is more building types and I'll talk about that a little later, how we identify the building types that we plan to use in this work. Try to get more stakeholder input on assumptions. Although we got a limited amount of that in the spring, we got very little stakeholder input after the presentation. Part of this work is to get people to make comments, both positive comments if they affirm that those assumptions are good or if they feel that there are better assumptions to come back to us and give us better assumptions in the data sources leaving to those better assumptions.

In the work that was presented last summer, the dollar energy cost index was based on the 8 cents per kilowatt hour, 56 cents per therm, costs that were used by the ASHRAE Committee in development of the standard. One of the things that we propose to do is to modify that and use regional fuel costs and data that has been developed through Department of Energy's annual energy

outlook.

We also plan to be able to use a regional heating fuel mix. We use again this 90/10 split across the country last summer. That's obviously not right. There are certain areas in the country where electric -- more buildings are electrically heated than in others. We want to try to capture that type of variation in this analysis.

Another thing we'd like to do is develop some aggregation across different building sizes. The standard impacts small buildings differently than large buildings. We propose in this analysis that addresses that. Again, the work last summer was based on a single size building so that's one of the enhancements that we've brought into the picture here.

MR. BROOKMAN: Jim.

MR. RANFONE: Jim Ranfone, AGA. I'm sorry, I want to go back to the slide before this where you made a comment that the presentation, the preliminary results were presented at the June meeting of 90.1 and that those preliminary results showed 16 percent site energy and 20 percent source energy savings in two types of buildings.

You made the comment that some sources are misquoting or misinterpreting that data or that comment or that result, rather, and has the Department or PNNL

come out with anything to say that those results should not be quoted for the entire standard because now we're in a phase where the standard is available, it's being sold and individuals or whatever groups may want to purchase it and utilize it may be of the mind that based on using that standard for the type of building that you didn't analyze would be obtaining those kinds of results of 16 percent site savings.

So has anything been sent out from DOE? I'm reading from press releases of some of your organizations and these statements are being made without any qualifications.

MR. BOULIN: The Department, Jean Boulin, the Department made it perfectly clear when this information was shared with people that this was a preliminary analysis and that we were intending to do a much more extensive analysis and that we were asking for comments on the approach we took. No, we have not gone out and tried to police the country and tell people they shouldn't say certain things about the standard or that they should.

We believe the information has been widely disseminated as to what it was and we are not in a position to police what other people say.

MR. RANFONE: Jim Ranfone again, AGA. I

know you're not in the position, but if the savings are being mischaracterized --

MR. BROOKMAN: Jim, are you suggesting that DOE do something about that?

MR. RANFONE: Well, I think DOE perhaps should indicate that the -- be more specific on what those results really mean. I mean if PNNL is now saying that some building types, you're actually going to see a difference or an increase in energy usage, I think when consumers or users of the standard are looking at this document and seeing information promoting it for sale and use, this needs to be addressed.

MR. BROOKMAN: When David was describing the earlier slide entitled "Past Work, What We Looked At Last Summer", I thought what he was doing there was differentiating what came before and separating that from this methodology that is going to be examined in detail today. That's what I thought.

That's what I thought we were going with this. That's why I'm asking what you would like to see DOE do with this, Jim.

MR. RANFONE: I'd like DOE at least to inform users of the standard, sellers of the standard that they should cease and desist making blanket statements that this standard is going to save 16 percent

site energy and 20 percent source energy. That's an important aspect.

MR. BROOKMAN: Additional comments on this subject before we move on?

Okay, thank you, Jim. I believe we're now on a slide called "Enhancements Proposed." It's page 3 on your handout.

MR. WINIARSKI: Right, and actually this is what we just discussed that Jim brought me back to. Another enhancement that we'd like to do with this analysis is to examine the effect of window/wall ratio on energy savings. This has been a topic of discussion that we didn't look at in the prior analysis. The prior analysis assumed essentially a 20 percent window/wall ratio for both the office and retail buildings. Obviously, there is a significant variation in that number and that impacts the building envelope significantly for the 90.1-99 standard.

So we want to examine that, where possible. Also to, if possible, come up with a way to aggregate that into the national savings estimate.

Although it's not discussed in your write up, one of the proposals is to look at the impact of the different major sections of the standard alone, for instance, what if only the envelope is adopted, what if

only the mechanical systems section is adopted, what if only the lighting sections are changed. That was not done -- or it was done in the work that we did last summer. I don't know that it was presented and obviously there are some assumptions in doing that because certain things impact the base loads on the buildings, certain things impact the efficiency by which that load is met. And so there's some assumptions in doing that, but we want to spend some time addressing that in this work.

Some of the other enhancements that we looked at, better accounting for the use of economizers across the nation. The write up discussions, the methodology proposed for that and I think that will be a significant improvement on the previous work.

The proposal talks about using a shipment weighted average efficiency for cooling and heating equipment where possible. Recently, through work with ARI and through work with GAMA on equipment standards, commercial equipment standards, we've gotten better information on equipment shipments and we hope to bring that into the analysis to come up with different or improved estimates of the relative changes in efficiency.

Another enhancement that I want to bring into the work right now is to bring in the residential size cooling equipment efficiencies. That's another

piece of the puzzle that wasn't done last summer. We didn't have shipment data on the less than 65,000 BTU per hour cooling equipment, three phase cooling equipment. That's in the standard and the standard did not address in its development.

The current 90.1-99 requirements are the same essentially as 90.1-89 and obviously there's no change in efficiency there. So that's one of the things that we're trying to bring into this analysis when we do the shipment weighted average efficiency improvements.

MR. BROOKMAN: Yes, please, Jason.

MR. GLAZER: Is the variation of window to wall ratio being included in the quantitative analysis or the qualitative analysis?

MR. WINIARSKI: I'll discuss that a little bit later. The present proposal that you've read on the -- or downloaded from the website talks about assuming a single window to wall ratio for the -- each building type in the quantitative analysis, but doing a sensitivity study of the effect of changing that window/wall ratio in a number of billing types to see what the effect would be.

There are some other ways to handle that and I'd like to get some input on that. One of the difficulties is the quality of data in terms of doing an

aggregation with window/wall ratio. But I'll discuss that a little bit later.

If you picked up a handout, something that was not on the website that you might want to look at is a flow chart that talks about the general process and as we walk through different sections, please refer to the flow chart in terms of where it fits in.

Let's see if this is the slide here.

(Pause.)

The basic proposed analysis utilizes a generic square building prototype. The prototype has 15 zones, 5 independent zones per floor, a core and 4 perimeter zones facing each of the cardinal directions, east, west, north and south. It has three stories, a bottom floor, a middle floor and a top floor obviously. And we've used this prototype in a lot of the 90.1 work because we have a zone, a separate zone that faces essentially each possible orientation of the building and it has a unique exposure and therefore we can use that building prototype to examine the effects of changing building size, shape, orientation or aspect ratio.

We'll talk a little bit later about this, but we've proposed to examine 7 building types: office, retail, education, lodging, public assembly, warehouse and food service. We've proposed 11 climates that were

used in the ASHRAE analysis with one minor exception, that we proposed to use a typical meteorological year, two tapes.

That data wasn't available in some of the early 90.1 work. We are switching one of the climate sites because of that and the rationale is discussed in the write up, but that climate is going from Orlando to Tampa. There is no TMY2 tape for Orlando. And those two climates are very, very similar in terms of their weather data.

We proposed to look at -- well, for each of the building types there are some characteristics that are relatively constant in the analysis. The schedules, occupancy, ventilation for the building, the equipment power density is assumed to be constant between both versions of the standard. Window/wall ratio in the proposed analysis is constant. We may look at modifying that, based on the assessment oft he folks here as well as at the laboratory.

We have talked about -- we'll look at the three permutations in terms of building wall type, again, a light weight wall or mass wall, heating systems and economizer usage, no economizer versus economizer for each climate. And each set of those permutations we can develop a set of 90.1 requirements in terms of the

envelope lighting power densities for the building, HVAC and service water heating efficiencies. All that information is fed into a simulation engine. In this case we plan to use BLAST and out of that comes EUI data for each of the individual zones, for each of the individual simulations.

That's primarily what I call the energy side of the analysis. The next part of it is how do you aggregate that since you've got all these different simulations for different regions of the country, different building types.

MR. BROOKMAN: David, any questions on that first flow chart?

(Pause.)

We can return to it. Keep going, David.

MR. WINIARSKI: Again, the next step in the analysis what I call the aggregation to a national commercial building energy use intensity estimates. You can follow through this flow chart. Basically, the process is to take that zonal EUI from each building, convert it to perimeter, total perimeter and total core EUIs for each floor of the building.

The purpose of that step is to -- well, the major purpose of that step is to wash out issues with building orientation. We aggregate the -- come up with

the perimeter EUI that's an average for the building and washout the effect that some zones are north, some are south. Because in an actual building we don't know how it's going to be oriented.

The next step, we bring in the cooling equipment shipment data and use that to assess the relative prevalence of economizer usage in each location of the country or economizer requirement usage for each location of the country. Once we've done that we move down to -- or take the individual climates and map them to what I call sub-census divisions. There are 9 census divisions. We actually are proposing to use 11. We split the east or western and mountain census divisions into two parts. The reason behind that is there's some significantly different climates, for instance, in the northwest versus California. And also there's some significantly different fuel prices and we want to try to capture that variation in the analysis.

Using CBECS data, Commercial Building Energy Consumption Survey data, we collect information for each census division on building size, building aspect ratio, number of floors, locations, again, perhaps window/wall ratio depending on how the analysis actually gets done. And use that to aggregate or to scale the results from the prototype building to the typical floor space in

terms of the six possible combinations of core EUI or perimeter EUI for each floor of the building.

So for instance, if you have a 7 story building, you have a top floor, you have a bottom floor, you have five middle floors that are relatively similar and you have a core and perimeter area for each of those floors. The idea is to develop from the census or from the CBECS data the square footage for each of the possible core perimeter combinations in that building, come up with relative weights for each of those six possible combinations and then bring them down to weight the EUI data for that building from the prototype.

We actually will do that probably at the census division level. We won't do it in individual building, but essentially you develop the total amount of square footage that would be applied to each of those six possible orientations int eh prototype building and then weight all the results appropriately.

Once we've done that we have -- for each of the sub-census divisions, we essentially have a number of building types that represent sort of the average building size, average building characteristics with the exception of the permutations that I've discussed above.

We then bring in data from CBECS again for heating fuel types, again, if we're going to look at

electrically versus fossil fuel heated buildings, that data is available to some extent in CBECS and we can use that to weight those two permutations. Similarly, we can look at the relative percentage of mass versus framed wall types and in each of those census regions or census subregions and use that to weight the results for those two permutations so weighting by heating fuel, wall construction data process.

Walk a little -- next step down, we have the data for each of the representative building types for each of the sub-census divisions. We want to weight the results for each representative building type in here by the total floor space for each of those building types in the census division. The next step is to aggregate across each of the sub-census divisions.

To do that we need the estimates for total construction growth for each sub-census division and also at that stage we try to bring in the variation on fuel prices across the country prior to doing that aggregation, so up to this point, the aggregation here, we essentially have site based fuel, site based EUI estimates for the whole building by fuel. In this case, we'll probably look at electricity and natural gas as being representative of fossil fuels.

Because there's variation in fuel costs

across the country, we try to capture that in this step before we aggregate it across all the census divisions.

Presently, the plan is to use -- after we've done that, aggregate to a national level using EUI's estimates for sort of the site source energy conversion efficiency. There's some question as to whether you should do that at the previous step or at that step. There's always some question as to what that conversion efficiency actually is and we'll probably get a lot of comments on that and I hope DOE can look at that and think what's the best way to do that particular step.

And then so finally the result is a national average site based energy use intensity for the building, BTUs per square foot, source based energy use intensity for the building and energy cost intensity for the building, dollars per square foot of commercial construction.

MR. BROOKMAN: Yes, Jason Glazer.

MR. GLAZER: Jason Glazer, GARD Analytics. I'm concerned that the approach being used with the number of permutations and the weighting is overly simplistic. It seems like there's a lot more factors in the standard and as many of you know I've recently completed very similar analysis and I found that I needed well over 12,000 simulation runs to properly capture the

effect of the standard and the approach that was outlined here and also in the paper implies that it can be done with about 600 runs.

I just don't see any justification for that level of simplicity on the importance of this determination.

MR. BROOKMAN: Can you describe what additional elements you would have the Department consider and undertake?

MR. GLAZER: Well, one of the elements Dave was talking about already is window to wall ratio. That's a definite that needs to be explored. Building size, he also mentioned in important, but I think that should be included in the permutations.

Others would be more variations in envelope construction, more variations in cooling equipment chosen, more variations in heating equipment chosen.

MR. BROOKMAN: Choose one of them. Let's take heating or cooling equipment. He's doing a class by class comparison, I presume. What would you suggest?

MR. GLAZER: Did you say for cooling equipment?

MR. BROOKMAN: Yes, or heating.

MR. GLAZER: Well, for cooling equipment I think his plan right now is to do a single type of

cooling equipment and it ignores smaller patched equipment like room air conditioners and also ignores chillers.

MR. BROOKMAN: So in your analysis you've done a much broader distribution in your simulations.

MR. GLAZER: Yes, I have.

MR. BROOKMAN: Okay. Other things that stand out for you that the Department should consider if they were to expand their analysis beyond the methodology described here?

MR. GLAZER: I guess in general I'd recommend an approach that's at least as thorough as what I've chosen and the report that we're going to be publishing fairly soon, we'll be outlining exactly the steps we took and I'd be happy to discuss those in more detail.

MR. BROOKMAN: Okay, and "we" being GARD Analytics?

MR. GLAZER: That's correct.

MR. BROOKMAN: Okay. David or Jean, do you have questions or follow on from Jason's --

MR. WINIARSKI: I might mention two things. One, I would like, Jason, for you, as we move through some of those areas to make public comments on things you'd like to see or variations expanded again. This was

sort of the overview of the process. I think there will be a place for that in a number of the other slides. And two, I don't know if it's possible, I know that you're going through sort of the internal peer review. I don't know if it's possible to get an overview of a lot of those permutations that you looked at sent in early to DOE. I know we've discussed them. I don't have all of them and so that would be useful.

MR. BOULIN: We've been invited to review that work. We appreciate the invitation and look forward to looking at the work.

MR. BROOKMAN: Let me say that these two pages of diagrams, these flow charts I think are especially useful so I thank the Department and PNNL for taking the time and trouble to array it this way. I think it makes it followable, whereas otherwise it would not be. So thanks.

MR. WINIARSKI: Briefly, I'll touch on one of the -- why we use a generic building approach for this type of analysis. I discussed briefly the generic building and it's a three story prototype. One of the feelings that we have is as we've seen with some other work that's been done, particularly on State codes there is a tendency to grab a building and model it, an existing building and one of the issues with that is that

it can bias the results significantly one way or the other.

That's part of the rationale behind choosing a generic prototype because choosing very specific buildings often doesn't add any value when you're trying to develop a national estimate unless you develop many more permutations or a whole bunch of building designs for your analysis that rapidly expand beyond the capabilities of our lab, at least, to deal with.

What is important is to establish the characteristics that distinguish one class of building from one another. Those building characteristics chiefly will focus upon building envelope, equipment usage, the building schedules and, in general, we can discuss building schedules in terms of the type of building although there's quite a bit of variation of building schedules and individual building construction within each building type, for instance, office or retail.

Again, characterizing a large class of buildings that have yet to be built requires eliminating as much as possible orientation and other biases that would exist in choosing the actual buildings or actual buildings that are under construction or have been constructed.

Basically, this is an overview of the

generic building prototype against three story, 15-zone. We have major parameters such as internal loads and schedules that differ by the type or representative type of building, again, the office retail warehouse. We then can use these individual zones which are in all different orientations to scale the results from this building to larger and smaller buildings.

The existing prototype that we use is a 48,000 square foot building. That was chosen as being a very median size building, based on CBECS data and curiously it's a median size building for a large number of prototypes, if you actually look through the data. Typically, you have around 40,000 to 50,000 square feet as being the median of the buildings for I think office retail and a number of others.

The systems that we try to model in this, again, we model the envelope, we model the interior lighting, power density for the building and those schedules thereof. For HVAC equipment, we model the different equipment efficiencies and the standard. Again, we are trying to use a weighted aggregate and the efficiencies or how we weight that or how we develop that aggregate efficiency actually does take into account a large number of both roof top systems as well as things like package terminal units, what we've done in the past.

We've looked at shipments for package terminals, looked at the shipments for roof tops and tried to come up with sort of an average efficiency for all those.

Again, the economizer usage, what we're looking at is modeling, the economizer use as a permutation and then as described in the analysis, looking for each individual climate the total amount of equipment that would be or would have an economizer installed for that climate based on the shipped capacity of equipment.

Service water hearing is modeled in the building. There's a number of issues of how you model service water heating that we'd like to get input on. The present proposal is to size systems based on the ASHRAE Handbook fundamentals and develop both a standby loss for an average water heater based on shipments as well as the load or the energy used that goes to meeting the water load in the building.

One of the things that we don't model very well is losses from the system components of the service water heating system, the tools that we have simply don't do that very well and that's an issue in the analysis. Again, that's one of those issues that we tried to look at in the qualitative analysis. This is the model results. This is how much we can be off because of those

type of system effects.

Infiltration in buildings is modeled again. We have assumptions built in for the model for the infiltration in the perimeter zones. What it out? We don't model elevators? We don't model cooking. We don't model exterior lighting. We have assumed base plug loads for the building. Those don't change between the 90.1-89 and 90.1R standards. So there's -- when you're coming up with a final percentage savings, you must be cognizant of the fact that these other uses were not included in the baseload. I think that's relevant.

It is not terribly relevant for -- certainly elevators and cooking are not terribly relevant for DOE's determination of energy savings. But they are relevant when you're looking at sort of a percent improvement.

MR. BROOKMAN: Jason Glazer.

MR. GLAZER: Jason Glazer, GARD Analytics. You mentioned some difficulties in modeling service water heaters. One thing that you might want to consider doing is instead of using BLAST, use the DOE2 simulation engine. It has a pretty good water heater model. In addition to DOE2, I think it's probably used a little more widespread. The BLAST generally has probably a little more industry consensus as far as its

applicability.

MR. BROOKMAN: Thank you. That's a helpful comment. So what I heard you saying there, Dave, is that -- well, let me clarify. These items that are out, they weren't modeled previously in 90.1-89 or 90.1-R and so that's consistent with what you said earlier on about this being a standard to standard comparison.

MR. WINIARSKI: The types of issues you get into are things like motor requirements that would have gone into elevators and efficiency requirements. That may be different between the two standards, and that we would not be addressing. Primarily, also those things are impacted by other federal legislation. The cooking again is not something that's covered in the standard, although there are things that affect, or there are building HVAC loads that may be affected by cooking usage. That's not modeled in our work.

Again, what we tend to look at are -- there are aspects again of cooking that -- for instance, washing or hot water usage for restaurants, that would get modeled. It will be based on whatever schedules and hot water use intensities we have.

MR. BROOKMAN: Additional questions on these slides?

Jason?

MR. GLAZER: On the issue of schedules, I recommend that the schedules that you should use would be the ones that appear in the compliance supplement which was developed by 90.1 committee members which is going to be published as part of the User's Manual. Those are a good set of schedules and a lot of thought was put into them, although there are a few small errors which I can discuss with you later.

MR. WINIARSKI: Okay. Yes, I would be interested. Jason, is that what you've used for the GARD Analytics analysis?

MR. GLAZER: Yes, I did.

MR. BROOKMAN: Additional comments on this before we move on to the next slide?

Okay, let's keep moving, Dave. We're going to go for about another 15 minutes. Then we're going to take a break.

MR. WINIARSKI: Again, talking a little bit about the schedules that have been proposed, the schedules and plug loads that have been proposed were based on ASHRAE 90.1-1989 work. Those schedules, we looked at them back in 1995 and 1996 and felt that there were some issues with how representative those would be and based on a number of different utility studies,

metering studies, including one of the largest commercial building metering studies that was done in the U.S., was done at Pacific Northwest Lab back in the early part of the 1990s, that's this ELCAP study that's referenced. And the schedules were modified thereof.

The schedules, if I can make available to those who have interest in them, they're fairly detailed and there's a discussion of those schedules in a 1996 work that was produced looking at equipment efficiencies for EPACT covered products and I believe it's referenced in the paper.

Again, plug load densities, similarly from the same source. Ventilation requirements. Our plan was to base the ventilation requirements on Standard 62-1989. Generally, those requirements are roughly 15 to 20 CFM per person. That is the requirements and the standard for new construction. Again, that's one of the areas where there may be significant variation between what's required in the standard and what actually gets put in in practice and if there's any comments that people want to make thereof, that would be useful information.

The present proposal looks at the envelope characteristics. It assumes an average window to wall ratio by each building type based on the CBECS data source. The U-values for the walls and roofs that would

go into the prototype building are based on the selective version of Standard 90.1 and the selected walls and roof types for the analysis. I'll go into that in a little more detail later.

For 90.1-89 they're also a function of the window-wall ratio for the building. In general, the attempt at 90.1-89 was to produce a constant whole building U-value, so if you added lots of windows you had to modify the construction of those windows to make them more efficient.

The solar heat gain coefficient or shading coefficient, depending on which version of the standard you choose to reference is also based again on the standard version and on the window-wall ratio chosen for the building prototype.

The proposed study does only assume single-zone equipment. It does cover a wide range of products or the aggregate efficiency would cover a wide range of products that would use single zone equipment, but -- or would be considered single zone equipment, but it does not address central systems.

There's a lot of issues with modeling central systems. They certainly, I don't feel, could be modeled terribly effectively with a scalable building model. You have lots of issues where you're modeling in

terms of how you've zoned the building. It's relatively easy to make a change in building zoning that can drastically affect the whole building energy use.

What I have proposed is to look at this from the point of view of the determination and can we effectively address the relative change in energy performance in the buildings for centrally zoned systems by looking at the efficiencies of the centrally zoned system as compared to the efficiencies of the single zoned package system, again, the qualitative matter saying yeah, this system appears to be more efficient and then making the point that the base thermal loads in the building are essentially the same in both systems.

That may not be the most appropriate way to do it. There's some other methods we can look at. One would be to basically do some comparison sensitivity studies where we take a given building size, zoned in a given way and compare the relative energy use for a central system in 90.1-89 and 90.1-99. We may want to look at that for some of the -- or for the types -- the building representative types that we think are some of the less well performing in terms of the energy savings.

Obviously, there's some issues here. You don't see a lot of large central zoned chillers applied

to warehouse building construction types. So there's some issues in how you would choose that representative type for the sensitivity study.

MR. BROOKMAN: Jason.

MR. GLAZER: Jason Glazer, GARD Analytics. I guess you're bringing a flaw of the way that the building zoning methodology that you're using is applicable.

The fact that central systems don't scale well with the zone by zone approach that you're using is a real problem and I guess I would encourage you to reconsider that and perhaps look at whole building EUIs with central systems as well as the zone by zone evaluation because I think the central systems are really a critical part of 90.1 and as you say there is a possibility that including them would reduce the energy savings and if that's the case it's possible that your determination by excluding that type of equipment could end up being overestimated as savings. So I think I guess I'd really recommend that you not follow the approach of ignoring central systems.

MR. WINIARSKI: I think I may have misspoke there. And again, it gets into what your definition of energy savings is. I don't think including central systems will reduce the energy savings in terms of the

absolute magnitude of energy savings for the country.

It may reduce the percent of energy savings that you get, but essentially you are -- what you have in a -- or the issues that you're faced with in central savings typically are you have higher fan statics, often with central systems. You have more chances or needs for reheating of previously cooled air in the system. But those are system efficiency changes.

They are not a change in the base thermal loads or what I consider the base thermal loads in the building that are developed from the envelope and internal loads or internal gains in the building.

The issue would be if there was a significant reduction in total system efficiency for central chiller boiler systems as compared to single package zoned systems and I haven't seen any evidence that there would be in the case with the standard, although that's one of the issues I'd like people to comment on.

MR. BROOKMAN: Jason.

MR. GLAZER: Well, I think that the loads are very different for central systems assuming you use a variable air volume approach. I don't think you can make the assertion there that you're making, that you don't believe it's necessary and have a feel for what the

energy savings will be. I think that's the reason to do an analysis is to discover just that and --

MR. WINIARSKI: It would be useful, Jason, if you can elaborate on where you think those specific differences might be in written comment.

MR. BROOKMAN: And beyond those differences, Jason, I heard you say a moment ago questioning the basic approach and so if you could say either now or in your written comments how that basic approach might get accomplished by the Department that would be helpful.

MR. GLAZER: I'd be glad to, in written comments.

MR. WINIARSKI: In particular, one of the issues or one of the reasons for the scalable approach is to develop an aggregated estimate. Obviously, there's some tradeoffs and what we're discussing here is one of the tradeoffs between aggregating up to a national number effectively and modeling sort of a more specific building.

MR. BROOKMAN: What I hear Dave, I think trying to characterize here is a kind of a best bang for the buck that methodology that tries to be adequately -- address complexity adequately, but not as vigorously as Jason, you said, by all the simulations and runs you did in your analysis.

That's what I think I hear being described.

MR. GLAZER: There's a point at which over-optimizing and reducing the number of simulations starts introducing larger errors.

MR. BROOKMAN: Yes.

MR. GLAZER: And I think that the proposal being laid out here is probably in that territory.

MR. BROOKMAN: So that's where the Department would benefit best from your comments on the methodology and also what you used as the basis, both methodologically and data wise.

Okay, how are we -- I'd like to do one more slide and then we're going to take a break.

MR. WINIARSKI: That's probably a good time for this. Again, the plan to use the 11 representative climates that I showed before in the flow chart, those climates briefly were the result of a clustering, statistical clustering analysis of the data from 230 odd TMY weather tapes. I think that work was done back in the early part of the 1990s.

Basically, looking at 11 different climate parameters developed for each of those weather sites and statistically determining a set of climates, in this case, a relatively small set of climates that best represented national weather data for specific, for

another large section of climates.

Those same climates were used by the 90.1 Committee in developing 90.1-99. There is a summary in the back of I believe what got put out on the website or if it's not there, it can be sent out to anyone, that describes that process and how that was developed. I think there were a number of papers that were actually published based on that.

MR. BROOKMAN: Jason.

MR. GLAZER: I have a comment about every slide, of course. I looked over that paper carefully and it seems to me the concept behind it was to select cities without knowing the eventual climate variation of the standard.

It was developed, the methodology was developed prior to any kind of specific climatological distinctions in the standard and I think using it now creates a bit of a flaw in the analysis because right now we do know what the climate variation and the standard is and it seems to me if you want to capture any effect of climate, the best thing to do is to look at the climate bins of the 1989 standard and the 1999 standard and make a determination, perhaps to a clustering analysis of all TMY cities within each one of those climates and determine what the best representative cities are, but

the 11 that were chosen ignore some climates that have significant construction and in fact, end up overloading some of the climate bins in the 1999 standard that are all, have identical criteria.

So if you're talking about bang for the buck, this isn't necessarily the best way to do it. I think you're actually doing more simulations in some areas that are not going to give you really any added benefit.

MR. WINIARSKI: Jason, in your analysis there were 14, is that right?

MR. GLAZER: Actually, I ended up finding that 10 climates were sufficient, but the climates that I chose were based on the trying to find a city that was most representative of the 90.1-99 climate bins as they appear in the envelope section.

MR. WINIARSKI: So it looked at the, again, it looked at the changes or it looked at the requirements and then picked cities that were representative of the requirements?

MR. GLAZER: That's right.

MR. WINIARSKI: And then --

MR. GLAZER: That way I captured as much as possible variation in the requirements of the standard.

I think these 11 cities were very good for

the development of the standard, but in the evaluation of the standard I think they are really not the most representative things that could be chosen.

MR. BROOKMAN: And so would you also provide those -- that analysis to the Department?

MR. GLAZER: Well, Jean will be seeing it next week at the peer review.

MR. BROOKMAN: Okay.

MR. WINIARSKI: Right, I'd like to be looking at the overlap there. I think that there is obviously an issue of whether you look at sort of the base climatological data and try and represent that first and then choose the cities or the -- let the standard sort of fall into that mix of base climatological data or whether you pick the -- use the standard to direct your choice of climatological data, but yeah, that will be good to look at.

MR. BROOKMAN: Additional comments on the climate slide?

Okay, I see none. It's now 10:45. I'm going to suggest we go to break. Before I do let me say those of you who walked into the building with computers, personal PCs, laptops, you probably need to get a property pass to get it back out if you haven't already signed up for one. They're serious about security in

this building, typically, so when you leave here today, make sure you've got your visitor's tag clipped to you somewhere.

The snackbar is one floor below us and across the hall. There's stairs about 50 feet that way and the restrooms are also down on that end and also on the very opposite end of the hall.

So it's now 10:45. Let's start up back again at ll. Have I forgotten any other housekeeping items?

MR. BOULIN: I think that's about it.

MR. BROOKMAN: Thank you for a good start this morning. We'll commence at 11.

(Off the record.)

MR. BROOKMAN: One housekeeping item, regarding the computers and the property passes that you'll require to get out of the building. How many of you have computers with you today? Just one or two of you, just a few of you.

Do you have a property pass yet? You do, you're all set. We want to make sure. Because they won't let you out.

Let me float one other housekeeping item past you. It seems like we're making real good progress moving through the slides and I know we have a few

written comments and perhaps some other things to be said once we go through the slides as we anticipate.

I'd like to suggest though if we get on towards noon or 12:15 or 12:30 and we're getting near the end of this material that we just plug on through it and not break for lunch at that time and call it an early day and press on with it. That would be my suggestion. I checked with a few of you at the break, that seemed to work for everybody.

Does anybody have an objection to doing it that way? Speak now. Okay, we're going to do it that way.

If it becomes an opportunity, we'll take it. We're not here to truncate this, but if we're moving right along as we have been, we'll press on with that plan.

Okay, Dave, it's yours.

MR. WINIARSKI: Briefly, this slide simply is a map of the climate locations in the country and in general, the areas that have been weighted to those climate locations.

The proposed study is based on seven commercial building types that are in bold on this table: office, mercantile and service or retail, as I refer to it often, education, lodging, public assembly, food

service and warehouse and storage. Together, those represent I believe it's close to 70 percent of energy use in this country based on CBECS energy data.

What we actually propose to do is and this gets a little bit into how we eventually do the analysis and actually gets into the window-wall ratio discussion, but the 1995 CBECS, the most recent version out breaks health care both into in-patient and out-patient health care.

In some previous work we considered the fraction of buildings that were in-patient health care basically 24-hour type facilities as hospitals as one building category and then took the fraction that was out-patient health care, essentially clinics and lumped those in with offices in terms of coming up with a prototype for the building, they typically have similar schedules, similar internal loads.

I don't know that that can be done with the previous version of CBECS quite as easily, so that may be an issue in terms of where we proceed with the window-wall ratio discussion later on.

MR. BROOKMAN: Jason has a question.

MR. GLAZER: You said that clinics, you thought, had similar hours of operation and internal loading to offices. That's not been my experience with

them. They usually have higher loads and often longer operation.

I was wondering if you had any data to support that.

MR. WINIARSKI: Probably not as much as we'd like and I think that's one of the areas that we should probably look at the 1995 CBECS data and potentially if other people have sources of information that might change that assumption, I think it would be useful to bring them into the mix.

MR. BROOKMAN: Jason, is it your comment that clinics would be more like say a hospital, 24 hour service, than they would be more like an office building?

MR. GLAZER: That was the conclusion that I came to.

MR. BROOKMAN: Oh, interesting.

MR. BROOKMAN: Because clinics generally do have usually very long hours of operation and any more they have a lot of high power equipment in them also. It's not unusual to see MRI and lots of x-ray machinery and such.

MR. BROOKMAN: Interesting, so I'm sure that -- getting support for that -- of that data, that sort of thing would be very useful for the Department.

MR. WINIARSKI: And one option is simply to

-- if we want to remove that building type again from the office building category as being not well represented, I'm not sure that there isn't enough variation both in each building type, there's probably a lot of overlap and there will be different extremes. I'm not sure that we will have enough information to characterize them as substantially different, but whatever can be provided will be great.

One key building type or I should say not a key building type but one that's been discussed and was not brought into this analysis was multi-family housing. Multi-family housing above three stories is covered by the standard and CBECS, in its residential counterpart, the Residential Energy Consumption Survey, really don't do a very good job of defining multi-family housing above three stories, either in terms of energy use or even total building square footage.

I have some data from Ron Nickson of the Multi-Housing Council and have looked at that. Believe that when you actually examine that it actually falls below warehouse and storage. In fact, I think it falls below food service. It represents perhaps one and a half to two percent of the energy use for buildings that would be covered by type standard.

MR. BROOKMAN: Jason?

MR. GLAZER: We ended up using a similar methodology as this to choose buildings that we used in our analysis, but instead of annual energy use, we looked at floor space as a criteria to select the buildings and one of the reasons for that is energy use is what's directly affected by the standard and seem to be -- have the potential of slightly skewing the results.

And the result of that ended up being that food service was not on our list and worship was, that ends up being a larger floor space area.

MR. WINIARSKI: Right, and that gets into sort of the issue, like we discussed with envelope, whether you direct your analysis based on the standards requirements or whether you base them directed on sort of a more fundamental basis.

In general, I was going to ask, in general, the building types are real similar though.

MR. GLAZER: Yes, they are.

MR. WINIARSKI: Between both studies.

MR. BROOKMAN: Does anyone have any opinions as to whether we should be addressing multi-family housing in this? The legislation makes a separate distinction between residential and commercial buildings.

Thank you.

MR. WINIARSKI: Again, these are the three permutations that I've really thought are the most significant with possibly the exception of the central to single zone type equipment. They are wall constructions, I know that the electric resistance versus fossil fuel heating sources has been brought up before and I think that we're sort of obligated to look at that as a significant issue.

And economizer usage, economizer usage is one of those areas where I think the 90.1, the stringency of the requirements in 90.1-99 have backed down. There were more economizers required in more climates, but there is some variation in that because the requirements cover more sizes of equipment in 90.1-99, but less climates.

So the impact of that is something that we really wanted to study. Let me drop back here for a second.

Again, we have proposed steel frame construction as the characteristic or most characteristic construction representative of light weight. Again, this gets a little bit into the issue of doing aggregations because the data source that we primarily use for some of this does not do a good job of distinguishing construction by actual wall construction, but rather by

the surface characteristics, what it looks like on the outside surface, whether it's got a masonry finish or whether it has a wood finish, something like that. And less in terms of how the wall was actually constructed. So any information that people have that looks at the relative amount of construction of the different types of steel frame, mass wall, metal building would be useful.

With the steel frame the present analysis assumes the use of a built up roof. That is to simplify the analysis, in general, in 90.1 -- well, the requirements in 90.1 are the least stringent for the most part are the least stringent for the built up roof assumptions and so we consider that conservative assumption on our part in terms of presenting energy savings. The requirements for the other roof constructions, for instance, wood frame with attic are generally much more stringent and have lower U-values.

One of the questions that I had and an issue that I'd like to get input if anyone has data on, again, we chose steel framing as representative of most building types. I don't know that it is -- I think that's probably true for -- in terms of a lightweight wall construction for most new commercial building. I have some question about warehouse. There's a significant amount, I think it's on the order of 10 to 11 percent of

new commercial construction that's done using metal building,

Butler-type building construction and anecdotal information suggests that a large number of warehouses would be constructed that way. But I don't have any data source to show that.

One of the reasons that may be important is that for warehouse construction, the metal building walls typically are less well insulated than the other building types and so if there's a significant amount of heating usage in metal or in warehouses, then having a less insulated wall becomes significant.

Again, another question that I have about warehouses and I'd like to get whatever data we can is how should we treat them in 90.1-99. In the development of the standard, warehouses were sort of linked to what's called a semi-heated space. Basically, the definition of a semi-heated space in 90.1-99 is a space that -- where the total heating capacity has been limited to a certain amount. That amount varies by climate, but in general, the idea was that you limit the heating capacity in the space so that the temperature in the space is never such that there's a lot of heating usage.

The internal temperature to external temperature variation is low. That's probably a

relatively good assumption for most warehouses, at least most nonrefrigerated warehouses and in general, when I've done the analysis here, I think of warehouses as one category and refrigerated warehouses as a separate category and not including refrigerated warehouses.

But there is some question as to what should be chosen as the typical heating setpoint temperature. A lot of warehouse buildings are heated primarily to prevent freezing, heated to 40 degrees. That was not how the requirements were developed. I believe the requirements were developed in 90.1-99 based on a 55 degree heating temperature. But it's not clear that that's a terribly good example for most warehouse construction.

Another issue that I'd like to get some feedback on from people is the assumptions for setback and setup in the building. The building temperature setback is not mandated in the standard, however, the requirement for the capability to use setback is mandated. In general, 90.1-99 has taken the approach of what they can mandate, what can be inspected by the building official. Obviously, things that deal with how things are controlled are difficult to assess and so what they've done is mandated the requirement.

Some background data, CBECS suggest that

virtually all buildings utilize some setback. Anecdotal information suggests that that's not terribly true and so any input either anecdotal or better data sources on that assumption would be useful.

The present assumption is to assume a temperature setback in all building types. Pardon me, with the exception of warehouse.

Discussion of window/wall ratio a little bit. This table shows the variation in window/wall ratio for buildings by building size for each building categories and based on the CBECS data source. Window/wall ratio is available in the 92 CBECS. It was dropped in the 1995 CBECS. Personal conversations with people suggest, the Census Bureau suggests one of the reasons it was dropped is that there was substantial difficulty in understanding the estimates for window/wall ratio.

To give an example of that, if you actually go into the data set, there are a large number of buildings where the actual window to wall ratio is expressed to 75 percent or above. Anyone who's involved in real construction knows that it's pretty difficult to build a wall that's 75 percent glass, particularly when you consider things like internal plenums.

I think that's -- what you get is people who

have gone out and looked at the buildings from the sides to see a curtain/wall construction building and have said oh, that's 100 percent glass, and again, looking at the outside of the building and not at the actual construction. So again, that's one of the issues.

But bearing that in mind, this is the type of variation that you see for small and average -- small buildings, the entire data set, and large buildings, by building type where the small and large have been differentiated by the average building size in CBECS.

What's important here is that you see that for office buildings there is substantial variation in window/wall ratio reported. For most other building types the variation is on the order of 50 percent, so choosing something that's an average, at least as a function of size here isn't all that significant, but for office buildings, which is something that I think most people know intuitively as you get to larger and larger buildings, you see a lot more glass used in them. And so that may be one of those areas where we want to modify the analysis to address either from a sensitivity study or from a methodology that can actually aggregate the data better.

MR. CROWDER: Harold Crowder. Dave, just a question on that. I'm wondering how you correlate these

square foot numbers to the 48,000 square foot number that you --

MR. WINIARSKI: Differences between averages and medians. The 48,000 square foot number basically represents a median, half the building is above, half the building is below in terms of what's out there. The average tends to be significantly smaller. There are lots of smaller buildings.

Where that type of information comes into play in terms of doing an analysis is obviously when you get to smaller buildings there's per square foot larger amount of surface area exposed and again, that's one of the rationales behind doing the scaling is to try to come up with a methodology that can really take care of that type of variation.

MR. CROWDER: Harold Crowder again. Would my assumption be correct then that you would be looking at a window/wall ratio approaching the 39 percent in your base building, the 48,000 square feet? What was the window/wall ratio --

MR. WINIARSKI: No. The window/wall ratio, I've actually done this two different ways and I've come up with -- well, three different ways and I've come up with essentially the same answer for the two that I think are most representative. This window/wall ratio that you

see here is basically if you took each building in CBECS, applied the appropriate weights because each of those buildings are a sample, part of a sample set.

Applied the appropriate weights to that sample as to how many buildings in the country it represents and averaged them. Not average, not weighting by floor space, but averaging across buildings. That's what these numbers represent.

The other way that you can do that or the other way that I think is fairly reasonable that you can do that is you can go through and for each building where you have, where you can take the aspect ratio of the building, the number of floors, and you make an estimate based on that of the surface area, the exposed surface wall area of the building and you weight it that way, what happens when you do that is these numbers vary about 1 percent, 0 to 1 -- I think in some cases maybe up to 2 percent from the numbers you see here. It's not a significant variation.

What you don't want to do and what I think is important is you don't necessarily want to weight the floor space or weight these buildings by the floor space they represent.

MR. BROOKMAN: Jason.

MR. GLAZER: This is a difficult issue,

especially given that CBECS 92's data is somewhat questionable, especially at the larger end of the percent of fenestration.

The approach that I took was to follow the categorization that CBECS 92 used, 0 to 10 percent, 11 to 25 and 26 to 50 percent and then over 50 percent and looked at the amount of floor space that each of those categories represented for each building type and I'm actually doing simulations at each one of those window to wall ratios and at the basically the medians at each one of those categories and then weighting the results by the floor space represented there. So it's a little different approach and actually those numbers look like they're a little more clustered than I would have expected.

There's a little bit -- from my perspective, it seemed like there was a greater variation than that.

MR. WINIARSKI: I would say I agree with you, Jason, and one of the points that or one of the issues that I wanted to bring up here, I haven't seen your analysis, but that is a good way to do it and that's my -- this is sort of the -- one is sort of what we're proposing here and then looking at stuff from a sensitivity standpoint, what happens if we take that building type, where there is substantial variation and

vary the window/wall ratio, how much did that change the answer?

The other option is to do exactly what you've talked about and that's my Option 2 here where you go through and you take each of the window/wall ratio bins and CBECS 92 for each bin or -- establish a characteristic window/wall ratio. The bins are fairly large and the upper bins are basically quartiles of 75 to 100, 50 to 75, but establish some characteristic window/wall ratio for that bin that you believe is representative and do the aggregation thereof so you basically -- window/wall ratio becomes a permutation in the analysis and I'm actually considering that as pretty strongly one of the options.

Again, one of the advantages that you have when you do that is that you capture, for each of those -- each building type, the entire variation of window/wall ratio that you could get in that building type and you'll find that, for instance, warehouses with 50 percent windows drop out because there aren't any. But one of the -- two issues for doing that, one -- and the approach that we've represented where we try and weight all these zones by the aggregate floor space, you do -- you force yourself into using the 1992 CBECS data set. That's not a big issue, but it's an issue that has

to be addressed.

Two, picking the characteristic window/wall ratio for each bin has to be done. And again, one of the proposals that might suggest is for that upper bin, you don't use the average, you use something like 75 percent or I don't know what you did, but something like that as perhaps more representative.

Anyway, comments that might have come in support or in argument with that approach would be useful.

MR. BROOKMAN: Jason?

MR. GLAZER: The approach that I used is to look at the over 50 percent bin as not really influencing where the median is. I set the median by the 26 to 50 percent bin. The over 50 percent bin, especially for offices, the percentages are probably errors in data collection, as you referred to earlier, so I think they're safe to ignore that as far as setting the median.

MR. WINIARSKI: So basically you had three bins?

MR. GLAZER: That's right.

MR. WINIARSKI: The 0 to --

MR. GLAZER: Zero to 10, 11 to 25, 26 to 50 and I did still include the weight of the greater than 50 percent as part of the 26 to 50 percent bin.

MR. WINIARSKI: And you used the average as characteristic for each bin?

MR. GLAZER: I used 7 percent window to wall ratio for the 0 to 10; 18 percent for 11 to 25; and 38 percent for the 26 to 50.

MR. WINIARSKI: Okay.

MR. BROOKMAN: Which includes all above 50.

MR. GLAZER: Which includes all above 50 also in terms of the weighting.

MR. WINIARSKI: The proposal talks about determining envelope requirements. What we propose is to use ENVSTD for the most recent version is 2.4 which is a program that attempts to or is basically -- takes the original 90.1-89 envelope regression equations used for establishing the envelope U-values and brings them into a computer form for people to use. Those values in theory should be the most representative of what's in the -- the requirements in the standard are. For 90.1-99, there are prescriptive envelope tables of U-values for each of the constructions and we would use those as the primary data source.

MR. BROOKMAN: Jason?

MR. GLAZER: I ended up not using ENVSTD in my analysis mostly because computationally it's too intensive and I'm interested to know what the approach is

going to be that you're going to use more precisely because ENVSTD doesn't give you an answer. It gives you a whole set of possible answers and then you need to optimize using some other variables to choose which one of those answers you want to use and that's a very labor and computationally intensive process that I did not think it was -- I personally didn't think it was worth it because the ACP tables in the 1989 standard are only slightly different than the results of the ENVSTD.

MR. BROOKMAN: Can you describe briefly what methodology you used?

MR. GLAZER: I used the ACP tables.

MR. BROOKMAN: Just took them as they are?

MR. GLAZER: That's right. And I think that there's -- this was a simplification on my part, but greatly reduced the number of other assumptions that have to make in using the ENVSTD also.

MR. WINIARSKI: Just to add something here, I think that this is one of those areas where the qualitative analysis comes in really useful. There are obviously two different ways to do this.

There are two different approaches to compliance for the 90.1-89 standard and given that there are two different sets of baselines that you can have, just on this one particular variable and I think this is

something that we should bring into the qualitative analysis in looking at the comparisons between what we come up with for the 90.1-89 ENVSTD method and then the ACP table method.

MR. BROOKMAN: How are you going to be picking the values with ENVSTD?

MR. WINIARSKI: What I will probably have is have Mark Halverson who has done this before speak to you a little bit more directly on that. The analysis that was done for the federal, proposed federal standard is the ENVSTD equations. As you said, the ENVSTD basically gives you a method to trade off, once you assess what window to wall ration you're going to have to trade off the U-value requirements for the windows and the walls.

And I believe what he did at that point was to look at sort of an optimum from an economic standpoint in using the cost data for the window and wall constructions that were used in development of the standard, pick what seemed to be the most reasonable set of window U-value and wall U-value criteria for a given construction type. Yes, it's labor intensive.

Again, the cooling efficiency will be based on shipped capacity weighting of the efficiencies of packaged cooling equipment. We're going to bring in the smaller three phase 65,000 btu per hour cooling equipment

now that we have -- at least what we think are reasonable estimates of the amount of shipments in that category that would go into commercial construction.

So a minor bug in this second bullet here, account for the allowed 0.2 EER deduction for the equipment for which that's in the standard. Basically, I wish Larry Westley was here. He could speak to that a little bit, but that is a deduction that the standard allows for nonelectric heating systems in the unitary packaged equipment. Basically, the reason for the allowance is the pressure drop over the heating section for a gas, for instance, for a gas heating system it's larger. It's significant fan energy.

What we propose to do is based on the given piece of equipment, go through and that fan pressure drop turns out also to be on the order of two tenths of an inch that would correspond to that particular 0.2 EER deduction and so we built that into the model.

And then as we talked about before we use a shipment weighted economizer usage by each census division. There is an improvement in jacket loss for both gas and electric furnaces that is built into the 90.1-99 standard. I shouldn't say improvement. There is a requirement in the development of the standard, manufacturers commented that the jacket loss in both gas

and commercial furnaces was on the order of 1.5 percent. That was used in the baseline development. A requirement for a jacket loss no greater than 0.75 percent was mandated in the standard and we have proposed the use of that. I think that's an area I'd like to get some comment on from manufacturers, if possible.

We need that basically to come up with a thermal efficiency for furnaces which goes into the simulation. The standard doesn't rate a thermal efficiency for furnaces. It rates a combustion efficiency and so what we've said is a thermal efficiency is essentially equal to the combustion efficiency minus jacket losses. And as I said we used the ASHRAE Applications Handbook to size the service hot water heating systems to come up with the characteristic standby loss versus energy used to serve the load in hot water systems.

Again, we're really into details here. Fan power assumptions. I discussed that in the write up. Fan power and lighting are two very similar issues in terms of how you treat them in the standard and what you assume for them in that they both have an impact on -- a direct impact on energy use as well as an impact on the loads of the building.

What we proposed is to use a one and a

quarter inch base static total static pressure for the systems to which we have built in some adders that are defined by building type, what we believe are characteristic. These were also used in some of the commercial equipment standards work that's been done recently. And then adders for both these and economizers and the gas furnace as I talked about before.

Again, the gas furnace adder is designed to provide a constant compressor performance for the system, the cooling system.

One of the issues with fan static obviously is that the standard -- go ahead.

MR. RANFONE: Jim Ranfone. I think you missed a slide, lighting density, power densities. Did we discuss that? It was mechanical.

MR. WINIARSKI: Let me drop back here. After mechanical, there's a slide that's missing?

MR. BROOKMAN: No, before mechanical.

MR. WINIARSKI: Okay. It did go through. Let me talk about that one then.

Let me finish doing fan power for a second. I'll come back to that. Obviously, one of the issues with fan power is the standard doesn't set, the standard has a limit that's probably at the high limit of what would typically be used for this system. Generally, I

think the limit is on the order of three inches and you're allowed extra allowances so it's hard to know what you should actually set it for, the extra allowances, if you've got extra filtration systems or something.

What we've done is try to assume what's a reasonable basis to come up with for this particular system type. If we went to a different system type, for instance, the central system, you would probably have higher fan statics. And again, this work comes out of, these numbers basically come out of discussions with manufacturers and 90.1 Committee Members.

I'll drop back here. Lighting power densities. Sorry, I missed that, Jim. That's a very significant area of discussion. The present proposal uses the whole building approach that's in both 90.1-89 and 90.1-99 for determining the lighting power densities used for the simulations. I think that there's some really good arguments to be made that it's -- that that's the appropriate or the most appropriate number to be used in terms of representing the savings that you're going to get by the standard, but we're looking for a lot of input on this particular issue.

90.1-89 and 90.1-99 both the whole building approaches attempt to capture the variation in lighting power density that you would find in commercial buildings

of given categories. And what they've done is they've mandated a prescriptive requirement for a maximum lighting power density in those buildings.

There's a second approach to compliance, however in both and that's a space by space approach where you go through your building, each individual space, the office, the hallway, the restroom and you have a requirement that you have to meet for those spaces. You add up all the requirements in terms of the lighting power for each of those spaces in the building and then the compliance requirement is that you have to have a total lighting power density less than that number that you get from adding up each individual space by space component.

It's difficult in using the space by space method to come up with a direct comparison, primarily because the 90.1-89 or the basis of the requirements in 90.1-89 are different than the basis of the requirements in 90.1-99 in terms of the 90.1-89 has a lighting power density requirement for space that is adjusted by an area factor that reflects the -- sort of the size of the space, the ceiling height, the wall height. You need all that information in the space to come up with what the actual lighting power density allowance would be.

The 90.1-99 requirements already include all

that information, so they're not a direct one to one comparison.

More importantly, perhaps at issue, I'm not sure it's more important, but one of the issues with the 90.1-99 requirements is that you have -- well, in both cases you have some additional lighting power allowances that you can take. Those allowances are for specific applications, for instance, for the use of special louvered lighting for visual -- video display terminals, for illumination of merchandise in retail applications.

Again, the requirements for the -- are by application and you don't really have a good idea of how often those requirements are actually going to be used in practice. It is an issue. It's one that we want to try to address in terms of the qualitative analysis.

One approach that we've looked at is to take the spaces that the 90.1-99 lighting committee used in determining their whole building or their space by space and whole building numbers, take those spaces, assume that you use the same space by space lighting power density requirements from 90.1-89 in those spaces, generate the effects of the room walls and size and develop a comparison table for those particular spaces that were used by the lighting committee and then add in or look at where those additional lighting power

allowances would come in, how much of the floor space would have to be taken up to meet or exceed the 90.1-89 lighting requirement, would have to be used in these additional lighting power allowances.

I think that's a real good approach. In most cases, those numbers are fairly high on the order of maybe of 70 to 80 percent, for instance, in a retail facility would have to use some of those additional lighting power allowances. But we'll look at that in some detail.

The other area that we'd like to get information on if possible is the fraction of buildings which comply to local energy codes using the space by space as opposed to the whole building methods. And that information is going to be difficult to come by. I think California has a space by space approach. We've made some calls down there and got numbers that vary from as little as five to as much as 50 percent, depending on building type.

MR. BROOKMAN: Jason and then Harold.

MR. GLAZER: The approach that I took, this is a very difficult issue and because there's multiple paths through both standards, it's difficult to say what exactly, a comparison between two standards is, but the approach that I took was can you design a building --

which is the most lenient path for designing a building? And in most cases it's the space by space method and I believe that the EPACT question is just that.

Will a building that just complies with the 1989 standard use more energy or less energy than a building that complies with the 1999 standard? And the problem using the whole building number is that they're not necessarily typical design practice at all.

I think what real design practice is is you put your lighting system together and then you go see if it complies or not and in most cases, in almost all cases, given the additional power allowances and other add ons in both standards, the question will be yes, almost every lighting system designed will meet both of those and part of the reason is that because electronic ballasts and higher efficiency fluorescent lighting, it's pretty easy to comply with the standard and so I think that if you were trying to look at how the impact of the lighting sections will affect actual lighting practice design in the country.

On a typical basis, the answer should probably be it will have no impact. If your question is buildings that minimally comply with both standards, then I think you have to look at the performance path or space by space method on a quantitative basis. That's the

approach that I took and I think it's the one that's most warranted.

MR. BROOKMAN: Thank you. Harold.

MR. CROWDER: Yes, my question is actually back on the mechanical, your last slide of the mechanical. Just clarification, what I thought you said was in the 1989 version the base static fan pressure could be 3 and in this modeling you're actually going to reduce that down to 1.25, is that correct?

MR. WINIARSKI: Not quite. The maximum allowed static pressure for both standards, I don't have the number off the top of my head, but it's approximately three inches, but you are allowed excess fan static for things like filtration requirements and such, so there's really no defined limit. What we've chosen to use is use what we consider a typical number and this might get into -- this kind of overlaps with lighting in that there's an issue here of whether you're choosing numbers that represent most typical or what we think are most typical or whether you're using numbers that represent sort of the maximum allowance of the standard, sort of the worse possible building design.

And similarly, you have the same issue with sort of the ACP tables. If you're got two paths to compliance, do you choose the least stringent path, the

worse possible case or do you use one that most people you think are going to use? There are obviously sort of fundamental definitional issues.

We'll let DOE work with those.

MR. BROOKMAN: I believe we're going back to mechanical systems now.

MR. WINIARSKI: I don't need those two.

MR. BROOKMAN: I think we're perhaps on the third slide under mechanical systems.

MR. WINIARSKI: I don't know if there were any other questions on the fan power?

MR. BROOKMAN: Yes, Jason?

MR. GLAZER: Actually, you just deferred to DOE on the decision of whether it's typical or maximum which is being evaluated here and I guess I'd like to know what DOE's opinion on this is.

MR. BOULIN: We've made no decision on that factor.

MR. WINIARSKI: Yes. I think that's one of the reasons, at least my understanding is that's one of the reasons for this type of workshop is to really address these issues as sort of an open forum.

MR. BOULIN: We're looking to be informed on this.

MR. BROOKMAN: Yes, please, say your name

for the record.

MR. GREISS: If we are looking a code, we should try to see what is the least energy efficient way of complying with it and considering this to be what we are imposing. We cannot assume good faith from the designer if we are imposing a code.

MR. WINIARSKI: This gets -- if I can speak to that a little bit, this gets somewhat into the issue of what's the end purpose of this determination and I'll speak a little bit, not from DOE's perspective, but from sort of my own perspective.

In terms of 90.1-99 there are some areas where I think there are some substantial improvements in energy efficiency. There are also some areas where I think that the standard has been relaxed in terms of stringency. In areas where people felt that basic practice or common practice of commercial designers was not to choose these areas where it would be terribly less efficient, but there may be particular instances where those areas are used.

An example might be, for instance, in the case of retail lighting for jewelry display or something like that where there is a reason that a building owner has decided to put in a very high lighting power density for a specific application and a specific area of his

building.

It's not clear that the majority of people would choose that path and in fact, if the median improvement of the standard is better, but the range of possible variation is larger it's hard to know how DOE should make that decision. If that makes some sense. There could be wide variation in the end produced by the standard if there's wide variation allowed in the given requirement.

MR. HEISS: Harold Heiss. In my experience with modeling you look at your project. In this case it is a minimum standard and I agree with that and from that job you develop your programming philosophy. For example, maybe if you had another type of job where you were trying to put the maximum stringency in you might start your modeling in a specific -- in that direction to look for the most stringent. So the modeling philosophy, I believe, to be used should be to gain the minimum standard and consistently do that in every section. That's my experience in my modeling careering.

MR. BROOKMAN: Thank you.

MR. WINIARSKI: Basically, the aggregation approach is kind of what we talked about before in the flow chart. Extract the zone EUI, convert to perimeter and core EUI data for each building floor, weight to

account to economizer usage and so forth. I'll let you kind of read through that. It's basically what was discussed in the flow chart.

Some key steps --

MR. BROOKMAN: Let's make sure everybody is comfortable with that slide. There's a lot there. This tracks the flow chart which I thought was a very helpful and much easier to follow than this slide.

MR. WINIARSKI: Right.

MR. BROOKMAN: Is everybody comfortable with that? Okay.

MR. WINIARSKI: The aggregation approach, some of the details here, we have some -- the Census has developed some construction valuation data recently for commercial buildings. We propose to use that data and again, it's valuation data so it's like dollars per square foot for a given region and so what we would do is modify that data somewhat using MEANS construction estimates for cost data by square foot for each of the Census divisions to come up with an estimate of total square foot growth for each -- for commercial buildings in each Census division.

We use CBECS as the primary data source for splitting the heating by the two primary fuel types, the electric and fossil fuel heating source. We would

probably lump oil with fossil fuel or with gas as a possible fuel source for most commercial buildings. There's not a tremendous amount of oil usage, at least with single, with packaged equipment. There's somewhat more with boilers, although it's less common than gas.

CBECS again would be used as the regional or national data source for wall construction weights by building type. What I propose here is to assume that the mix of buildings that will be built is the same as the historical mix.

You get into issues with using CBECS as a data source in that as you start to subset things like the mix of buildings and the Census divisions or regions that the sample size in CBECS becomes too small to adequately represent sort of a national or an estimate for that region so what we propose here is to use the historical mix. Another option might be to use something like the last 20 years of data or you may want to vary that or we may want to vary that by building type. If there's a lot of office buildings you could use maybe the last 10 years of data, but that would not be appropriate for a smaller population of buildings and CBECS like food service or warehouses.

MR. BROOKMAN: Harold Crowder.

MR. CROWDER: Yes, the question is, Dave,

you've mentioned in a couple of different times different CBECS. Which CBECS are you using in this case? Is it the 1992 or the 1995?

MR. WINIARSKI: Well, in this case it depends on sort of where we go with the window/wall ratio assumptions. If we do a single window/wall ratio and vary the -- a single window/wall ratio for a given building type and do a sensitivity analysis, then I'd be very comfortable using the 1995 CBECS for this. If we go to the bins such as Jason used, I probably would go with the 1992 CBECS for the entire data set.

I think I would prefer to be consistent in that respect between the two data sets and my guess is that the mix of buildings is not substantially different, given the three years of -- the three years of growth that were brought in between those two data sets.

MR. BROOKMAN: Jason?

MR. GLAZER: We ended up using the 1995 CBECS data set except in cases where the information wasn't present.

One question I have about the aggregation methodology is that there seems to be the possibility of a little bit of extra error introduced in the weighting process by going first to regional and then to national numbers.

Wouldn't it be more effective to use the data set directly on the climate bins that are being simulated and then use that to come up more directly within one step to the national numbers?

MR. WINIARSKI: I'm not sure how that would be done.

MR. BROOKMAN: Jason, repeat the question. You lost me on that.

MR. GLAZER: Well, I guess this comes back to how you're choosing your weather files and what they're representing, but the way we chose it each weather file represented a climate bin in the 1999 standard, the envelope portion of the 1999 standard and we use the CBECS data, disaggregated to that level whenever possible. And it seems like a more direct way than what you're proposing here.

MR. WINIARSKI: Let me go back. What we're proposing essentially maps the relative contribution of the given climate types to each of the Census divisions. And what you're proposing is to --

MR. GLAZER: Well, I used a different approach. I guess the best thing to do would be at some point you should probably look at the aggregation strategy I decided upon. It's a very complicated topic. But you need to be careful -- I guess the one word of

caution is you need to be careful adding extra steps. If you don't need the regional information for an answer, I wouldn't go there unless it's intrinsic in the way you're doing your weighting.

MR. WINIARSKI: Right. The regional data primarily again here is used to assess the relative contributions of the things that the permutation is on. For instance, the wall type construction, the relative contributions of the fuel mix and as much as possible we know that there is substantial variation in the country, try and assess that variation. And hence, going from the climate zones first, figuring out what's the contribution of climate zones to each set of data or each region or in this case the sub-Census regions and then looking at the variation in these permutations in that region, if possible. In some cases where we can't do that, we may have to use sort of maybe national data, if there's not enough data points to come up with something that's statistically significant. But it is a complex subject and certainly getting a chance to review your data will be helpful.

And that's just what we talked about, statistical significance of CBECS data. Again, the question about whether the historical mix, if that's what we should be using or if there's a better data source in

terms of representing the building types, construction types or any other permutations that we're looking at, like window/wall ratio. The other thing I'd ask people to look at is the order of the aggregation steps and whether they believe that seems to be the correct order for doing the aggregation and will provide the type of numbers at each subset that are going to be useful for people who want to look at the analysis. What we propose to do is have the data available so that people can, if they want, the EUI data go through other possible permutations of how you would aggregate it.

Sub-Census divisions, I spoke about those briefly. Essentially, they're to split the Pacific and Mountain West sub-Census divisions. That's done based on population data, primarily. Again, the three zone model I talked a little bit here, there's a building level aggregation that's done, that's based on the use of a 15-foot perimeter depth assumed for the building and scaling appropriately. That can be varied. That's simply the values that we've used in the past and what the 90.1 Committee felt were pretty representative of actual practice.

And where it becomes important, primarily where that becomes important is when you start getting into a central system type design where zoning becomes

much more of an issue in terms of reheat and other things.

The last step in the aggregation or the last two steps deal with the calculation of the utilization indices for source and energy costs. I talked about in the flow chart where that occurs. This is simply a discussion of what we believe those definitions mean, site-EUI by fuel type consumption in terms of btus measured at the customer's site. Source EUI, what we propose to use of national basis, the DOE/EIA electricity source conversion efficiency. We may want to look at that from a sensitivity analysis if we looked at perhaps regional source sufficiency data if that's available. And finally, the energy cost.

The number will be calculated using EIA's estimates for fuel cost data by Census division. We have done some splits for the EPACT standards work to look at how that varies across the two sub-Census division splits, the Mountain and Pacific again and that will be out for people's review here in terms of whether they think that's reasonable, whether that's the best possible data source that we have. I think that's one that we felt was most representative.

MR. BROOKMAN: Jason?

MR. GLAZER: What's the specific reference

for the 10,301 number?

MR. WINIARSKI: Off the top of my head, I'll see if I can find that for you. I believe it might be -- it's in the AEO 2000, but I'd have to find the actual page and reference it.

What we will try and do is again want to get this sort of proposal flushed out, want to get as much comment and input and if possible sort of constructive criticism on what's a good way to approach it and how much -- what sort of a level, a variation that's needed for DOE to do this analysis. Again, it's focused more on the determination of whether there will be energy savings rather than the actual number and again, it's focused more on the comparison of standard to standard rather than in actual construction which we recognize we don't have a very good baseline for.

We will provide again, as much detail as we can on the assumptions, the input parameters for the simulations that are developed based on those assumptions. Copies of input decks and detailed results at each step of the quantitative analysis. And if possible we would like to participate in discussions with people on inputs and again the additional simulations that we felt might be appropriate from either the quantitative viewpoint and the aggregation or from a

qualitative assessment of particular details.

I think that about wraps it up for me.

MR. BROOKMAN: Questions for Dave about the -- all these slides collectively or comments at this point. What we're scheduled to do next on the agenda is listen to some individuals that have already written comments that are scheduled to speak and take other comments at that time and then I guess we'll assess where we are for the rest of the day.

Questions directed at Dave following his presentation.

Harold?

MR. CROWDER: Yes. Harold Crowder. Dave, is this available, have you put it on a website so that we could have a copy of your presentation?

MR. BOULIN: We will post that on the website. There was a little bit of confusion on which portion of the site it will be on. It will be posted on the energy codes portion of our website.

MR. BROOKMAN: Is that a new website?

MR. BOULIN: No, that's an old website that's -- they're linked together, but that's maintained at our Pacific Northwest National Laboratory.

MR. BROOKMAN: I see. Because normally the website is www.eren.doe.gov.

MR. BOULIN: You can get there that way too. It's just harder.

MR. HEISS: Harold Heiss, again. Dave, you're going to take all the input that we give you and we've heard that in modeling there's numbers of different ways you can go about anything. And it goes back to the philosophy that I was speaking to earlier. What will you use -- how will you make a decision what elements to use and what means to use. Is that your decision in the end? Speak to that, please.

MR. WINIARSKI: I suppose since I'm kind of the task manager it is my decision in the end. I will try and get as much input, if possible, where people have a -- would request a change in the analysis or would request an increase amount of analysis, looking at a particular issue, I have to sort of make a judgment between the time and funding available and whether I think that's the most appropriate avenue. Obviously, this could become extremely extensive very quickly, as Jason, I'm sure, knows.

It's -- there's also a lot of issues whether the -- if the additional variation is the type of thing that will significantly impact energy savings or are there more important variations or more important assumptions early on that get into -- that would affect

the energy savings that you should address first. It's sort of easy to get into the weeds on this. But I will look for as much input where people are putting in a proposal, to be as detailed as possible about why this is a better assumption or a better approach and what would be the real difficulties, scientifically, with the approach that we presented out.

We also have some -- there's always limitations again on resources to do this type of work. And I think we have to be very cognizant of.

MR. BROOKMAN: Other questions, specific or more broad as Dave is about to sit back down, I think, and we're going to move on to the next aspect of the agenda.

MR. BOULIN: Let me make a comment on that. I think the ultimate decisions on what assumptions are used in the analysis will be made by the Department. We will be looking for the advice and input of the people at PNNL and the people around this table and those who send comments in.

MR. WINIARSKI: The other thing, if I can broach this, also consider if possible where the comparisons may not -- may be fairly straight forward. Look at stuff and whether that can be done in a simple requirement by requirement type comparison in the

qualitative analysis.

I think that we may end up looking at that where we get into some issues on individual, for instance, individual system requirements, things like what do you have for setback on chill water systems, something like that, where it's very difficult to model and it's not sure how you would aggregate the data if you did model it.

MR. BROOKMAN: Final questions or comments. We're going to move on, I believe.

Thanks, Dave, very nice, nicely done.

We have three individuals that are scheduled to speak and I believe your comments relate to the written comments that you had submitted already to DOE.

Are there other people who wish to speak at this time in addition to Jason Glazer, Jim Ranfone and Harold Crowder?

Okay, I don't see anybody else. If anybody decides they wish to -- you're welcome to join in at the end.

I'm wondering if it's possible, seeing as how you've already prepared a written comment to summarize these comments rather than read them in their entirety into the record. Am I correct in this, Jean?

These written comments will be inserted in the written record, will they not?

MR. BOULIN: Yes, they will.

MR. BROOKMAN: So I'm wondering if it's possible to do that. If it isn't, then I guess we'll listen.

Jim, you're first -- excuse me, Jason's first on the list.

Jason, you want to start off, please?

MR. GLAZER: Actually, I think a lot of the comments that I've made already are very relevant to my statement, but I guess the only thing in addition I'd like to mention specifically is that the one week period after this meeting for further comments is just not sufficient for the level of technical information that you're looking for to be provided and I'd encourage you to do 30 days or something more on that order.

MR. BOULIN: I don't see any problem with that. I was thinking about that when we have been asking for various input. I think we can -- we will extend that period.

MR. BROOKMAN: Thank you, thanks for that comment. Next is Jim Ranfone.

MR. RANFONE: Okay, thank you, Doug. Jim Ranfone with AGA. And I'll yield to your request since

we did submit a written statement. I will provide you with an updated version of that, so it's slightly modified, with some additional information, but I'd like that to be added on the record. Just summarizing one thing, we do also request a 30-day time frame. We felt that this was just a little too fast. We appreciate DOE's efforts to accelerate this process, but we were a little surprised that getting an announcement on February 8th and a workshop on the 17th and one week to comment on, so we do appreciate the suggestion that there will be a 30-day.

One other thing on a couple of other things, peer review of the DOE analysis. We did meet with Assistant Secretary Reicher back in October and one of the things we asked for and we believe we had an agreement is that we would be able to participate as other interested parties in a peer review and secondly that if there are differences between the analysis that GARD is doing versus what PNNL comes up with that there will be a third party available to review both analyses and make some kind of determination of why there's differences.

One issue that wasn't discussed today, well, is our concerns with the qualitative comparison. We have some comments on that -- I'm sorry, we did discuss that

a little bit. We don't favor a qualitative comparison. I think the law is very clear as to what needs to be done here in terms of does the new standard save energy or not and we recognize there's a lot of gray area there, but putting a lot of time into a qualitative analysis without really knowing how that's going to be used by the Department and I think some comment from DOE staffer sort of summarized everything, how you're going to do that, what's going to be used. We don't favor an extensive qualitative analysis to be done.

Another issue that we have is on the concern with fuel switching. We believe that that should be a part of this analysis in terms of looking at what the impact will be on adoption of the 99 version. We do go into a little bit of detail in showing or our allegations or our estimates that we're going to increase the cost to some of the natural gas appliances and equipment that go into the standard and competing products.

And not only gas, but we're talking about electric heat pumps, the cost of that product is going to go up and even the oil equipment. We'd like to see some kind of analysis done on fuel switching, what the potential would be if that should occur because the Committee in their deliberations and some of the analysis that DOE supported on the equipment side did show an

increase of cost of somewhere in the area, for example, 8 to 10 percent on gas water heaters and no similar analysis was done on electric resistance water heaters.

One other thing is that we think that DOE should consider forecast of commercial construction activities in their analysis, what -- how that's going to impact the types of buildings that are going to be built because the standard only applies to what's going to be built in the future and not what's currently being built. And I'll just summarize it that way. Again, we'll provide a copy of the detailed --

MR. BOULIN: Would you comment a little bit more on that last piece on --

MR. RANFONE: On forecasting?

MR. BOULIN: Yes, what do you think the Department should do in that area?

MR. RANFONE: Well, what we think is that you ought to take a look at some of the forecast on the types of buildings that are going to be built using publicly available sources like Dodge studies or GRI's "Baseline Projection" because types of buildings, the mix of the types of buildings that are going to be built or are going to be impacted by the 99 version and that's the analysis should be centered around that projection, not on existing building stocks as we know today.

MR. BOULIN: Do you have any opinions about the time frame?

MR. RANFONE: The time frame for?

MR. BOULIN: Of the forecast?

MR. RANFONE: Ten years, 5 to 10 years out, whatever the baseline is.

MR. BOULIN: If ASHRAE plans to update its standard every three years, is 10 years an appropriate time frame?

MR. RANFONE: Well, for this analysis, I believe it is and when you say they plan to -- what ASHRAE does, I mean we've already had this discussion this morning on addendum and on how that could be evaluated. If we're looking at a bulk analysis right now based on the 1999, 1989 version, I would project it out for the 10 years.

MR. BOULIN: Thank you.

MR. RANFONE: We also appreciate the opportunity we had to present here and the workshop. I think there's a lot of good information being discussed. A lot of this data and the work that both PNNL and GARD are doing are going to help in the promulgation of additional changes to the 90.1 standard, so it's not just an ending process. I think the evaluations, the assumptions, the decisions that are being made and the

technical judgments that are being made are going to be fed into the process again.

MR. BROOKMAN: Thanks, Jim. Harold Crowder is next.

MR. CROWDER: Yes, thank you. I too would like to echo Virginia Power's appreciation for the invitation and the chance to participate in this workshop and this process. I will summarize my comment, written comments as well. Unfortunately, I get to call attention to a typo that I made and it allows me to make some -- place undue emphasis here, unintended emphasis.

In my second bullet where I talk about Virginia Power having taken a look at the study that was presented in June of 1999 to ASHRAE, I should insert the following, ASHRAE 90.1-99, that it will, in our opinion, save energy over the previous version.

Then secondly, I'd like to say that in looking at this current proposed methodology, we feel that you have adequately addressed the shortcomings that you identified in that earlier analysis and finally, that Virginia Power endorses the maintenance of fuel neutrality in codes and standards such as ASHRAE 1999, 90.1-99.

Thank you.

MR. BROOKMAN: Thank you. I am going to

-- I want to thank you personally for what I think was a really an informative and well done workshop and I'm going to turn it back to Jean Boulin. Jean, thank you, and I'm going to hand out evaluation forms and I'd like to ask you to fill them out and it's going to take you a very brief amount of time. So I'm going to pass these out.

MR. BOULIN: I would like to echo Doug's appreciation for your participation and the time you spent here and particularly responding to such short notice of this meeting. We will extend the comment period until March 17th, that's St. Patrick's Day and we do appreciate your additional input and your response to our queries here.

I think that's all we really have to say here and travel back home safely.

Thank you.

(Whereupon, at 12:21 p.m., the workshop was concluded.)